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ABSTRACT

Three categories of information are presented in this issue of "Science for Society: Education Review," published by the Commission on Science Education of the American Association for the Advancement of Science. First, as examples of promising innovations in science teaching, there are brief reviews of a secondary school course, Science for Society; and a college course, Biology: a Humanities Approach; and three catalog-type descriptions of new college-level courses. A number of 1972 National Science Foundation (NSF) summer institutes on environmental or science-society topics are announced. The remainder of this issue is concerned with a listing of modules of instructional materials. An annotated bibliography of representative modules is presented. (Author/PR)

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New Courses and New Materials

Three categories of information are presented in this issue of *Science for Society: Education Review*. First, there are brief reviews of a secondary school course and a college course, as examples of promising innovations in science teaching, and three catalog-type descriptions of new college-level courses. Then a number of 1972 NSF summer institutes on environmental or science-society topics are announced. The remainder of this issue is concerned with modules of instructional materials. An annotated bibliography of representative modules is presented.

We invite readers to send to us other examples of new secondary school or college courses and of useful instructional modules that they have prepared or that have come to their attention. Reports may be addressed to Science Education, AAAS, 1515 Massachusetts Avenue, N.W. Washington, D.C. 20005.

A High School Course in Science for Society

Concern for environmental problems has caused some science teachers to change the content of their courses. They have added laboratory exercises or have developed units for study of a wide range of environmental topics. These efforts meet students' needs now, but in my view do not provide for a real transfer of study to the larger problems that science and technology present to society.

The need I saw was for broad education in areas that are problem-oriented. The topics, I felt, should not involve single-solution, analytical problems, but rather those with several possible solutions, all viable with varying degrees of excellence, thus putting the student and teacher on equal footing, and promoting discussion of creatively devised, alternative answers to the pressing problems of our time.

I also believed that a student should become an "expert" in a field or topic area of special interest to him. For this purpose, two papers developed during the year were required, the first being a literature search of his topic, and the second either a behavioral or laboratory "research" project related to his paper.

The school administration, interested in curriculum innovation, allowed me to sponsor the course, which has been conducted during the past two years. Enrollment has increased each year and students' enthusiasm has been stimulated.

The philosophy of the course has several points worthy of consideration, but attention is called to two main points. The first premise is that all of our problems lie in value conflict. If we could build models for the resolution of value conflict, and if we were able to determine what variables are the best indicators of conflict resolution, we would be well on our way to a more peaceful world. But, we don't have this information; we are faced with value conflict which we must resolve. The message of my course then is to keep one's self open to **all** possible alternatives when dealing with these topics.

The second point is the fact that we live in a time of confusion and ambiguity. This, of necessity, dictates that one's education take a futuristic view. One can no longer train himself for one occupation, but must be able to change with the changing needs of society. So, one's education must have a broad base of course work and experiences, making it possible to live in and contribute to society.

The course itself is divided into two semesters of work, the first being devoted to a number of lectures on specific topic areas covering: (a) the nature of science and technology; (b) historical interrelationships of science and technology; (c) population; (d) urbanization; (e) food and natural resources; (f) energy and nuclear power; (g) environmental pollution; (h) automation and privacy; (i) technology and war; (j) biomedical engineering; (k) technology and assessment; (l) values and science; (m) religion and science; and (n) the future.

In addition, discussions are held after each lecture. About 30 films are shown, most of them free. Special activities include city planning, technology assessment of a national data bank, and population, each taking a week. Games from the Education Research Council of America, such as the *Redwood Controversy*, *Mouse in a Maze*, and *Planet Management* were used initially, but have not been continued since they became commercial.

There is no assigned textbook, but the students are required to read five paperback books varying in title from year to year, but dealing with the following subjects: introduction to the problem of man and society, history of technology in brief, value conflict and change, and the use of emotion rather than reason in consid-

ering problems. Assigned reading, usually from current journals as need or interest arises, is also required. Five tests are given throughout the semester which concludes with a two-day written examination and a 10-minute oral examination. At this time the first paper is due. Grades are computed from scores on these examinations.

The second semester has a changed format. The class meets three days a week rather than five, and the grouping is different. The sessions are for student seminars based on papers prepared in the first semester and on any additional findings. Each student makes two presentations to groups of students who have conducted similar investigations or have similar interests. Other activities include guest speakers from surrounding communities who work in interest areas. For example, one man spoke on sewage treatment, and a Congressman was asked to speak on public support of science policy.

The purpose of the second semester work is to show students how to present their findings in a manner understandable by all the others. It is also hoped that new areas of information will be freely shared. The second semester concludes with an oral defense of one's project and submission in writing of findings. Grading is based on both these activities.

The course is pleasurable and rewarding to me and exciting, current, and relevant to my students. After some exposure, they begin to discover sources of information not normally accessible to me, and they themselves are learning because they are interested. The course as described is geared for able students, but I am confident a course of this type can be developed for average students. The opportunities are limited only by the imagination of the teacher and by his willingness to devote time to background reading and development.—James D. Maloney, Walsh Jesuit High School, Cuyahoga Falls, Ohio 44222.

Biology: A Humanities Approach

My own interest in developing a nonmajors course in biology has been several years in the making. From 1958 to 1963 I taught genetics to majors and graduate students. After the Kennedy assassination I felt a strong need to reach a wider audience to relate biological theory and human values. Partly, this was motivated by the realization that most social issues, such as war, pollution, overpopulation, racism, aggression, malnutrition, abortion, and fallout were directly or tangentially related to biology. Also, I felt that the Kennedy credo, which asserted the value of the individual in bringing about social change, should not die with his assassination. Although I was successful in communicating concepts and the intellecutal excitement of basic biology to majors, I felt that the decisions of applied biology were made primarily by legislators, businessmen, and housewives and that, therefore, the nonmajor was the most important component of society in applying or ignoring the biology affecting his life. In retrospect, it seems unusual that the nonmajor should be so ignored. He is, of course, somebody else's major and thus as inherently equipped to learn as the major. The indifference to his earnestness reflects a self-centered attitude that pervades concerns within a department for its own priorities. It was this change in outlook that forced me to rethink the objectives and methods of teaching undergraduates and that led to the presentation of the nonmajor's biology course as a humanities approach.

The philosophy of the course takes as its premise that neither a survey nor a principles approach is suitable for the nonmajor. The course assumes an interest in the human condition and it is this theme that unites the concepts of biology for the nonmajor. The concepts are the cell, the gene, molecular biology, development, and evolution. They were selected because they provide the means for approaching the human condition from a biological perspective.

This human condition is only faintly known to us but it is the cause of our concerns and anxieties as parents, as patients, and as bewildered victims of fate. We enter life as infants with a 1 percent chance of having an abnormal chromosome number. This defect could limit our life to a few days, or impair our capacity to learn, or traumatize our sexual identification. About 5 percent of all newborn infants have an inherited or acquired birth defect which will require medical attention if the newborn victim is to function normally. Ten percent of all couples attempting to have children will be infertile; and, paradoxical as it sounds, sterility frequently has an inherited basis.

Our longevity and our general health is affected by our particular collection of genes that our parents passed on to us. If the load of mutations we bear is too high, our life may be cut short in its prime or our experience of life may be a more-than-average participation in surgery, prescribed supplements, and impaired effectiveness.

It is not Mendelism as such that appeals to the nonmajor but its use in studying hemophilia, color blindness, or sickle cell anemia. It is not mitosis and meiosis that excite the nonmajor but the necessity of understanding them so that nondisjunctional diseases become comprehensible. The nonmajor knows he will be a parent someday and he can identify readily with the knowledge that 25 to 40 percent of spontaneous abortions are associated with abnormal chromosome numbers.

Whether the student is white or black, it is relevant to him to know how his skin color is inherited. It is even more challenging to his values to see skin color inheritance as a population problem in time. Here his historical knowledge of the one-way rape and seduction of black women in the North American slave trade can be applied to the past, present, and projected miscegenation rates in the U.S. He can see how this situation contrasts with the miscegenation among whites, blacks, and Indians in Brazil and other Latin American nations where a different historical basis for miscegenation led to different values and racial identification and composition. In turn this can be contrasted with the sit-

uation in West Africa, the ancestral home for the North and South American blacks.

If the relation of genes to characters is extended beyond simple Mendelian traits, students can appreciate the complexity of most character traits. Thus, intelligence can be followed from Galton's studies a century ago through the Jensen report today and thereby the student learns to analyze what is genetic and what is environmental in the composite makeup of socially significant traits.

Molecular biology provides the insight into how genes work and—more important to the nonmajor—how they malfunction. Mutation takes on a new significance as the effects of radiation on genes and chromosomes are seen at the chemical and cellular level. What is added to our foods, what is prescribed to a pill-hungry public, and what is sprayed on our crops becomes significant when we learn how chemical agents alter nucleic acids in our chromosomes.

In unfolding the sequence of events from fertilization to birth, development can become intellectually exciting. I deliberately choose human sexuality as a topic to illustrate development because it is a revelation for the student to learn how his sex is determined by genetic, chromosomal, and hormonal events affecting a common set of structures in the early embryo. Male and female alike are formed from a sexually neutral fetus. To the student familiar with the Yin-Yang complementarity of Eastern mysticism, a new dimension is added when he becomes aware of the total complementarity of the development of male and female structures.

There are so many examples by which a concept can be illustrated with the human condition. Also some concepts appeal to the intense interest of the undergraduate in the world he wants to remake. The teacher must constantly seek such examples in reading newspapers and journals. He must retain a noncompartmentalized attitude so that every novel, every play, and all his adventures in living, become relevant to his teaching. For this reason I believe that the nonmajors course should be taught by an experienced teacher. He has to have an intense familiarity with his field: he has to know, from experience, how much material a class can accept in a single lecture. He must know how to organize it in a flow of ideas that lead the student to insight and anticipation and draw on the student's own awareness and curiosity about his condition. In using the lecture as a device for this form of learning, the teacher must develop the skill of pacing his prose. He learns to listen to a variety of silences. If his ideas are being grasped, a feeling of intellectual communion exists between him and his students; the silence is total. If he has shot past his student's attention, the silence is punctuated by a disturbed rustle and the experienced teacher then knows to change the pace and devise a repetition which introduces the material again in a new form without sounding repetitious.—Elof A. Carlson, Division of Biological Sciences, State University of New York, Stony Brook, New York 11790.

Science for Society in the Engineering Sciences

Hofstra University

Development of undergraduate programs in the science-for-society field is receiving more and more attention from educators. Lee Rosenthal of the Department of Engineering Science, Hofstra University, Hempstead, Long Island, New York 11550, offers a course, "Technology and Society—Impact and Implication." Its description:

> Past and present interactions of technology with society. Implications of technology for future life with respect to the physical environment, artificial intelligence, genetic control, ethics, values, culture, and human freedom and responsibility. Topics include computers, automation and cybernetics, city pollution, the impact of technology on medicine, human engineering, and the humanities.

University of Rochester

A new environmental pollution course designed to bridge the gap between general seminars and advanced technical courses began in February (1972). Assistant Professor Herman R. Osmers (chemical engineering), University of Rochester, wants his course "to come to grips not simply with the problems but also with methods for their resolution."

Osmers hopes to attract a broad range of students to the course, which is open to technical and nontechnical majors at the university and also to members of the Rochester community who are interested in learning how to solve environmental problems. Prerequisites are general chemistry and calculus. Osmers emphasizes that an extensive technical background is not required. Titled "Abatement of Environmental Pollution," the course will be given in two parts, one semester on air pollution and another on water pollution.

New Courses at WVU

The Terra Alta Biological Station announces a new instructional design and early opening for 1972. Two 4 1/2 week sessions will take advantage of the seasonal timing of the biota under study and will make maximum utilization of the unique locale of the Appalachians of Northern West Virginia. Herpetofauna of the Central Appalachians, Ornithology, and Taxonomy of the Vascular Plants will be offered from May 15 through June 9; Geobotany of the Allegheny Mountains, Field Studies of Invertebrates, and Seminar in Ecology will be offered from June 12 through July 12. Inquiry should be directed to: Professor R. L. Birch, Director, TABS, Department of Biology, West Virginia University, Morgantown, West Virginia 26056.

NSF Institutes and Short Courses: Interdisciplinary Environmental Studies

BAYLOR UNIVERSITY, 7 weeks, June 26-August 11: *Introduction to Environmental Problems; Physiological Ecology;* for teachers of biology and chemistry. Dr. Virgil Tweedie, Department of Chemistry, Baylor University, Waco, TX 76703.

UNIVERSITY OF CALIFORNIA, BERKELEY, two 3-week programs, July 17—August 4 or August 7—August 25: *Environmental Studies*; for teachers and supervisors of science in the Berkeley area. Prof. Donald L. Dahlsten, Lawrence Hall of Science, University of California, Berkeley, CA 94720.

THE UNIVERSITY OF IOWA, 8 weeks, June 12—August 4: *Contemporary Problems of Society; Ecological Studies; Pollution Problems; Seminar in Interdisciplinary Environmental Studies;* for teachers of biology and social science. Dr. Robert E. Yager, Science Education Center, The University of Iowa, Iowa City, IA 52240.

KNOX COLLEGE, 2 weeks, June 19—June 30: *Curriculum Development in Science-Technology and Society;* for teachers of science. Dr. Herbert Priestley, Department of Physics, Knox College Galesburg, IL 61401.

NORTHWESTERN UNIVERSITY, 4 weeks, July 10—August 4: *Economic Problems of Illinois and Their Relationship to the National Economy;* for Illinois teachers and supervisors of economics and other social sciences. Dr. Theral T. Herrick, Illinois Council on Economic Education, 1740 Orrington Avenue, Evanston, IL 60201.

THE OHIO STATE UNIVERSITY, 8 weeks, June 26-August 18: *Environmental Sciences;* for teachers of science. Dr. Victor J. Mayer, Faculty of Science Education, The Ohio State University, 1945 North High Street, Columbus, OH 43210.

POLYTECHNIC INSTITUTE OF BROOKLYN, 2 weeks, July 17—July 28: *Recycling of Municipal Wastes;* for teachers of science in the New York area. Prof. Henry F. Soehngen, Department of Civil Engineering, Polytechnic Institute of Brooklyn, 333 Jay Street, Brooklyn, NY 11201.

SAINT JOSEPH COLLEGE, 6 weeks, June 26—August 4: *Environmental Studies; Research;* for local teachers of physical science. Sr. M. Clare Markham, Department of Chemistry, St. Joseph College, West Hartford, CT 06117.

SHORTER COLLEGE, 3 weeks, June 12—June 30: *Natural Resource Use;* for teachers and supervisors of science. Dr. Philip Greear, Box 2, Shorter College, Rome GA 30161.

THE UNIVERSITY OF TEXAS AT EL PASO, 3 weeks, July 17—August 4: *Environmental Quality;* primarily for El Paso teachers of science and social science. Dr. James L. Milson, Department of Curriculum and Instruction, The University of Texas at El Paso, El Paso, TX 79968.

VANDERBUILT UNIVERSITY, 4 weeks, June 19—July 14: *Drug Use and Abuse;* for teachers and supervisors of biological sciences. Dr. Oakley S. Ray, Department of Psychology, Wesley Hall, Vanderbuilt University, Nashville, TN 37203.

UNIVERSITY OF WISCONSIN—RIVER FALLS, 4 weeks, June 12—July 8: *Organic Chemistry; Pesticide Use and Residue Control;* for teachers of agriculture who are also teaching high school courses in science or mathematics. Dr. James C Dollahon, Dean, College of Agriculture, University of Wisconsin—River Falls, River Falls, WI 54022.

UNIVERSITY OF WISCONSIN—RIVER FALLS, 4 weeks, July 10—August 5: *Environmental Science; Environmental Management;* for teachers of agriculture who are also teaching high school courses in science or mathematics. Dr. James C. Dollahon, Dean, College of Agriculture, University of Wisconsin—River Falls, River Falls, WI 54022.

UNIVERSITY OF WISCONSIN—WHITEWATER, 8 weeks, June 12—August 4: *Interdisciplinary Approach to Community Environmental Quality Improvement;* for teachers of the physical and social sciences from Wisconsin and neighboring states. Dr. Charles B. Varney, Department of Geography-Geology, University of Wisconsin—Whitewater, Whitewater, WI 53190.

UNIVERSITY OF WISCONSIN SYSTEM, at Clam Lake Field Station, Clam Lake, Wisconsin: 6 weeks, June 18—July 28: *Environmental Assessment;* for teachers of science. 1 week, July 26—August 2: *Program Evaluation and Implementation;* for administrators from schools of participants. Dr. Roy E. Heath, Board of Regents of University of Wisconsin System, Box 912, Madison, WI 53701.

Modules: An Approach to Instruction

Recognizing the nationwide need for and interest in modules of instructional materials, the AAAS Commission on Science Education has embarked on an investigation of recently published materials presented in modular form. The modules briefly described in this issue of *Science for Society: Education Review* are not necessarily viewed as the best of those produced so far; they are only representative of a great number noted in scanning current professional publications. Many more having special merit could be cited.

It may be useful to be aware of the criteria used in identifying modules for this bibliography. Many are not so labeled; some may be termed teaching packages or bear other designations. Stated simply, however, a module is a self-contained and independent unit of instruction with a primary focus on a few well-defined objectives. Ideally, modules should include clearly stated objectives and they should provide for student activities that can be carried out independently by the student. Desirable characteristics are that they be investigative, interdisciplinary, inquiry-oriented, and stimulating. Not every module cited has all of these characteristics.

The basis for classifying the materials is the level of their most likely use: in elementary, secondary, undergraduate and post-college teaching.

This bibliography was prepared by Dr. William E. Chace, Washington, D.C., editor of the first three issues of *Science for Society: Education Review.*

Elementary Level

Learnings in Science, Science Research Associates, Inc., 259 East Erie Street, Chicago, Ill. 60611.
There are four separate "laboratories" in this program for elementary students: "Earth's Atmosphere," "Weather and Climate," "The Solar System," and "Biogeography." The laboratories contain research booklets separated by divider cards. Each section represents a basic concept of the science studied. The first set of questions tests student reading of material; the second, his ability to apply what he has learned. Students engage in both school and home experiments using easy-to-obtain materials. Manuals, charts, etc., are included in the program.

The University of Illinois Astronomy Program, Harper & Row, Evanston, Ill. 60201.
This program, with its six texts and separate guidebooks. "Charting the Universe," "The Universe in Motion," "Gravitation," "The Message of Starlight," "The Life Story of a Star," and "Galaxies and the Universe," is designed to develop theory at a convenient pace. "Highly interdisciplinary, interweaving astronomy's use of mathematics, physical chemistry, physics, geophysics." Prepared for grades 5-10.

Mr. Wizard's 400 Experiments in Science, well known from TV broadcast and now incorporated in a book by Don Herbert and Hy Ruchlis (Book-Lab, Inc., 1449 37th Street, Brooklyn, N.Y. 11218, $1.95).
This book provides modules for student activity grades 5-9. Materials used are easily available within the community.

On My Own—Bite Size Science, Harcourt Brace Jovanovich, 757 Third Avenue, New York, N.Y. 10017.
Typical of several publishers' approach to modular instruction. It consists of a series of leaflets for the student with reading difficulty and offers 50 investigations per level. Some investigations can be completed in a class period; others require several days. Leaflets and a science dictionary comprise the materials.

Earth Corps Study Program, Scholastic Book Services, 904 Sylvan Avenue, Englewood, N.J. 07632.
This is a multi-media, activity-oriented, flexible program useful with both social studies and science. Materials include teaching manuals, student activity books, transparencies, photos, posters, and wall charts. For grades 1-6.

Science Reading Adventures, American Education Publications, Education Center, Columbus, Ohio 43216.
This series is directed to a particular reading level. The ten or so units (modules) in a single booklet, capitalizing on themes of expected student interest ("Spying on Spiders," "Jet Away in a Giant," etc.) constitute activity-oriented lessons. They call for process skills in observing, classifying, inferring, using numbers, measuring, and communicating.

Secondary Level

Environmental Themes

Adventure in Environment and *Adventure in Environment—Outdoor Book*, by National Park Foundation with cooperation of National Park Service (Silver Burdett Company, Morristown, N.J., 86 pp. and 54 pp. respectively).
Each book, planned for secondary student use, features 21 unit presentations which might well be termed modules. Each unit is self-contained and well illustrated, with encouragement for investigations by students in the environmental area. Titles providing a flavor of student activities: "What Color Is the Wind?" "You, Frogs and Home," "Can You Hear a Scene?" Activities cut across many study fields.

NEED (National Environmental Education Development), NESA (National Environmental Study Area), and NEEL (National Environmental Education Landmarks) are programs of the National Park Service, involving use of guides, filmstrips, etc., for the purpose of developing environmental awareness, understanding and values through use of existing curricula. They can be applied in art, music, mathematics, history,

and social studies. Workshops have been established to promote understanding and use of these programs. For information write: Office of Environmental Interpretation, National Park Service, Washington, D.C. 20240.

A Curriculum Activities Guide to Water Pollution and Environmental Studies, Institute for Environmental Education, 2803 Scarborough Road, Cleveland Heights, Ohio 44118, Vols. I and II, $15.00.
Most of the units presented in this edition admirably lend themselves to the preparation of modules for the use of basic and advanced level teachers and students. A typical unit, as found in the section "Ecological Perspectives," contains an introduction (including purpose), key questions, equipment listings, procedure, previous studies, limitations, and bibliography—with diagrams as required.

GM Progress of Power, Technical Information Department, GM Research Laboratories, Warren, Michigan 48090.
A "state of the art" report called *Progress of Power* featured 44 exhibits and 26 special vehicles. The vehicles were powered by unconventional systems—turbine, steam, electric, Stirling, and hybrid systems as well as experimental piston engines that sharply reduce emission of air pollutants. This publication contains information on the experimental power systems and vehicles displayed. GM also publishes a 4-page bimonthly, *Search*, devoted to efforts to control pollution from motorcar engines. See also, *Progress in Areas of Public Concern*, available from GM Proving Ground, Milford, Michigan 48042.

Our Environment Series, EMC Corporation, Dept. H 1203, 180 East Sixth Street, St. Paul, Minn. 55101.
Consists of four multi-media program packages. The themes: Fresh Water Communities, Sound and Noise, Aesthetics, Atmosphere. Each package contains filmstrips, records, teachers guide, wall charts, spirit master for worksheet and follow-up assignments. Intermediate grade use.

Man and His Environment: An Introduction to Using Environmental Study Areas, National Science Teachers Association, 1201 16th Street, N.W., Washington, D.C. 20036, 55 pp. $1.75.
Shows the educator how to use the environment as a setting for teaching art, mathematics, science, social studies, and communication, thus enhancing the possibilities of instruction via the module method.

Conservation, Education Division, American Petroleum Institute, 1271 Avenue of the Americas, New York, N.Y. 10020. This picture discussion kit is a flexible teaching instrument for use in grades 7-9. Its aim is to focus attention on wise use of natural resources. Other titles of materials produced by the Institute in modular form are: *Earth Science and Energy, Conserving Our Waters and Clearing the Air, Energy and Economic Growth.* The latter was prepared for students in senior high school economics courses.

Physical Sciences

Reactions and Reason, an introductory module, by high school teachers and teachers in the Department of Chemistry (University of Maryland) in cooperation with the Science Teaching Center, University of Maryland, College Park, Md. 20742. Seeking to design a new approach to the study of chemistry, these professionals, without benefit of grant funds, have produced a trail edition, with teachers guide, of the first of eight interchangeable modules. Purposes of the overall program are to popularize chemistry and to extend chemical education to a larger audience by making it "more interesting, more fun, more readily adjustable to local situations, and more in tune with the times." The group plans to reinforce and extend the concepts of chemistry presented in the introductory module with others having geochemistry, biochemistry, and inorganic, organic, nuclear, physical and environmental chemistry themes.

How the Jet Engine Works is a sample title of materials of the modular type offered by the American Gas Association, Inc., 1515 Wilson Blvd., Arlington, Va. 22209. The kits, designed by teachers for the purpose of applying the principles of natural gas energy to the student's world, are for use at the junior and senior high and junior college levels and in science and social science studies. The materials include experiments, overhead projection transparencies, student report sheets, wall charts, and filmstrips.

Conservation in Petroleum Energy Conversion is the title of one of several module-type programs made available by the Standard Oil Company of California, 225 Bush Street, San Francisco, Calif. 94104. The components: A teachers guide, a student manual, a student resource book, and a bulletin board presentation of the processes in making petroleum products and steps of the industry to prevent pollution. Developed by educators at California institutions, the program has a suggested timetable of three weeks.

Social Sciences

Public Issues Series, American Education Publications Unit Books, published under direction of Donald W. Oliver and Fred M. Newmann, by AEP, a Xerox Company, Education Center, Columbus, Ohio 43216, 1967 ff., each 64 pp., illus., 35¢ ea.
A series of 28 booklets on public issues, based on a program at Harvard University where scholars and classroom teachers—and high school students—were brought together to seek better ways of approaching the social studies. The program eventually was expanded to 12 college and university centers designated by USOE as part of Project Social Studies. Each unit is intended to involve the individual as a thinking, acting participant in history. A teachers guide, *Cases and Controversy*, describes the purpose and instructional strategies of the series. Sample titles: "Science and Public Policy," "Negro Views of America," and "Population Control."

Science in the 20th Century, Modern Dilemmas Unit, Modern World History Series, supplement to Bulletin 216, Montgomery County Schools, Rockville, Md. 20850, 1971, 44pp.
Prepared in a teacher workshop, this publication seeks to show where scientific principles are applicable to the social and behavioral sciences, and how scientific advances have caused social change. Instruction calls for cooperation of art, English, and science departments. Each "module" in the program is replete with suggested activities, current readings, resources, keys to student self-evaluation, and auxiliary films.

Episodes in Social Inquiry Series, published as part of the Sociological Resources for the Social Studies Program, Allyn and Bacon, Rockleigh, New Jersey 07647, 1965 ff.
Sponsored by the American Sociological Society and supported by NSF, this project has thus far resulted in the production of 23 short paperback units on vital topics, inviting student involvement and student interest. A sample tetle is *Testing for Truth: A Study of Hypothesis Evaluation.*

ERIC Clearinghouse for Social Studies/Social Science Education and ERIC/SMAC at Ohio State University have prepared with USOE assistance a report identifying materials and programs considered worthwhile in the environmental education field. A number of these provide for instruction along modular lines. Write to ERIC Clearinghouse for Social Studies/Social Science Education, 970 Aurora Street, Boulder, Colorado 80302.

Miscellaneous

Industrial organizations have developed kits containing sample products accompanied by equipment and workbooks for experiments; e.g., Union Carbide's program featuring "Seed-Gro" and "Micro-Gro" for use in elementary and secondary life-science studies.

Another example of commercial groups offering module-type educational materials is the aviation industry. The Cessna Aircraft Division, Wichita, Kan. 67201, has prepared a list of "Specific Resources for High Schools" itemizing aviation texts, sources of materials, and teachers guides for high school instruction.

Professional organizations developing individual projects of the module type include the Oregon Psychological Association which is experimenting with a Traveling Operant Lab for high schools. The lab, which includes an itinerant pigeon, a cage, an operant chamber, and a control panel, is available to interested schools. With it come instructions, suggestions for experiments, and a lab manual. Delivery is made by a psychologist who briefs the teacher on the lab's use.

The National Public Relations Association, NEA, 1201 16th Street, N.W., Washington, D.C. 20036, has prepared a series of cassettes, records and filmstrips, most for administrators and teachers but some for students. Among the latter is "How To Study and Why," including two records and two cassettes. They can be used by large groups or by students individually. The ten messages include "How To Take Notes," and "How To Do Homework." Record album, $9.95; cassette album, $18.50.

In October 1970 the Division of Curriculum, Department of Public Instruction, Grimes State Office Building, Des Moines, Iowa 50319, issued a four-sheet memorandum, with bibliography, on "Learning Packages." Such packages are essentially modular since the definition is: "A conceptually based program of instruction, using multi-media and multi-mode techniques, and designed to individualize instruction according to the individual aptitudes, attitudes, and interests of students."

College and Graduate

Matter-Antimatter and Cosmology and *Continental Drift* are the themes of two of a series of Physics Resource Packets sponsored by the Commission on College Physics and prepared primarily to help two-year college physics teachers in presenting one or two lectures on a given topic. Each packet contains reprints of leading articles on the subject, a series of related slides for the lecturer's projection, and suggested further reading. Available from American Association of Physics Teachers, 1785 Massachusetts Avenue, N.W., Washington, D.C. 20036.

Short Courses. A considerable number of professional associations periodically present short courses for their members which include lectures, films, filmstrips, guides, and charts, all for the purpose of bringing participants up to date on specific phases of the organization's field of interest. The courses offered by the American Chemical Society, 1155 Sixteenth Street, N.W., Washington, D.C. 20036, are perhaps the most comprehensive. ACS has developed 60 short courses, presented first at national or regional meetings and then sold as kits (lectures, films, and filmstrips) for use by groups or individuals. The Society terms as *modules* the assembly of courses in a single field, e.g., under the heading "Chromatography" and separate courses in gas, modern liquid and thin-lay chromatography. Each requires one to three days for execution. The Council on Education in the Geological Sciences, 2201 M Street, N.W., Washington, D.C. 20037, is another example of professional organizations which sponsor or stimulate short courses and seminars to update their members and make the materials available for use by other interested persons.

Statistics for Problem Solving and Decision Making is a course presented through 10 half-hour films and 10 related texts in an individualized instruction format, no instructor needed. Aimed at executives and professionals in marketing, accounting, business systems, engineering and related fields. Course covers: concepts and vocabulary; describing collections of data; getting information from data; collecting data efficiently; charting, forecasting, deciding between two alternatives, estimating the cost of uncertainty, relating two or many variables. The VISTEX course (Visualized Instruction with Structured Texts) has no prerequisites outside of basic mathematics. Contact: R. L. Craig, Westinghouse Learning Corporation, 1426 Westinghouse Building, Pittsburgh, Pa. 15222.

BIOTECH Teaching Modules for training biotechnicians will be developed by AIBS during 1972-73. Emphasis will be placed on eight topic areas, among them animal techniques, e.g., handling rodents; and microbial culture methods, e.g., how to isolate a single cell. Write to: John H. Busser, Director, Project BIOTECH AIBS, 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016.

Science for Society
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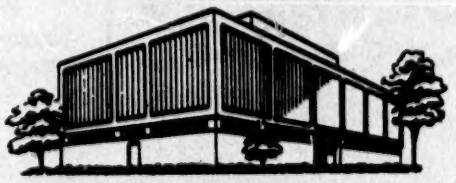

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American Association for the Advancement of Science
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Notes

The Use of Modules in College Biology Teaching, Joan G. Creager and Darrel L. Murray, eds. (Commission on Undergraduate Education in the Biological Sciences, 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016, 1971, 173 pp.).
A valuable source book for any study of modules, biological or otherwise. In the preface Edward J. Kornomdy, former director, CUEB, says that the development of modules offer "a decided opportunity to effectively achieve individualization of learning" and submits that "modules will perhaps become the major pedagogical tool in education—at all levels!" Representative subjects treated include: "What Modules Are and What They Do," "Advantages and Applications of Modules," "What Some Current Modules Look Like," and "What Future Development of Modules May Bring."

A 200-page catalog "Video Tapes for Teacher Education" (Fall, 1971) is the product of the Video Tape Project conducted at Carleton College, Northfield, Minn. 55057, and supported by grants from the Charles F. Kettering Foundation and the NSF. Fifteen nationally recognized curriculum study projects as well as many schools cooperated. Tape descriptions cover modern foreign languages, science and mathematics, and social studies. A valuable source book for teaching courses along modular lines, especially in open-ended discussions of problems associated with the classroom teaching-learning process.

The NSTA (1201 16th Street, N.W., Washington, D.C. 20036) makes available an excellent series of "How To . . .," timely aids for developing modules. Each of the 18 pamphlets contains an analysis of the topic, photos and charts, instructional suggestions, and bibliographies. Three recent titles:
How To Study the Earth from Space, by Robert E. Boyer, Professor, Department of Geological Sciences, University of Texas at Austin, 12 pp., 50¢.
How To Read The Natural Landscape in Forests and Fields, by Millard C. Davis, Editorial Associate, NSTA, 12 pp., 50¢.
How To Present Audible Multi-Imagery in Environmental Ecological Education, by Pascal L. Trohanis, Educational Technology Center, College of Education, University of Maryland, 8 pp., 50¢.

Individually Prescribed Instruction, a special report of "Education U.S.A.," 1201 16th Street, N.W., Washington, D.C. 20036, 32 pp., 1968. Preparation of this booklet is based on John Gardner's prediction that within 25 years virtually all instruction in schools will be individualized instruction. Example cited: A reading class of 63 in suburban Pittsburgh uses a learning center where students work independently and at their own pace—with expert guidance and adequate equipment. Most crucial task for the teacher is providing each student with the most effective prescription for achieving lasting understanding of each step on the IPE learning continuum. Teacher training program, built on the same concept, contains 12 packages. Self-diagnosis is stressed.

Performance Based Teacher Education: What Is The State of the Art? (American Association of Colleges for Teacher Education, One Dupont Circle, Washington, D.C. 20036, PBTE Series, No. 1, 1971, p.9) includes among implied characteristics of such education the requirement that it be modularized. Then it defines the term: "A module is a set of learning activities (with objectives, prerequisites, pre-assessment, instructional activities, post-assessment, and remediation) intended to facilitate the student's acquisition and demonstration of a particular competency. Modularization increases possibilities for self-pacing, individualization, personalization, independent study, and alternative means of instruction. It also permits accurate targeting on the development of specific competencies."

Of possible interest in the study of modules are the following books, available from ERIC Clearinghouse on Education, Washington, D.C. 20202, and authored by Walter R. Borg: *Guidelines for Developing Minicourses, Possible Research Questions Related to the Minicourse Model, The R & D Process as Used in Designing Minicourse.* $3.29 ea.

Programs for Improving Education in the Environmental Sciences 1971, published by the National Science Foundation, Washington, D.C. 20550, 24 pp.
This pamphlet gives a listing of projects, directly or indirectly related to environmental education and supported by the Division of Pre-College Education in Science and the Division of Undergraduate Education in Science of NSF. It is a valuable reference on many activities in this area, especially for discovering places where programs involving modular instruction are being developed.

Illustrative of the growing role that museums are playing in education by making exhibits, records, pamphlets, and films available to schools—many of them useful in developing modules—is the program of the New York State Museum and Science Service, Albany. Lessons on selected subjects by staff members are published and loan kits are made available.

Constructing Instruction on Behavioral Objectives, by Henry H. Walbesser, et al., University of Maryland, College Park, Md., 1971, 60 pp.
This booklet, with the subtitle "A Manual for Managers of Learning," shows teachers how to base their instruction around the concept of establishing behavioral objectives. Possibly of use in developing courses featuring the modular approach.

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